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ABSTRACT

Any physiological process which can be monitored in some way may provide biofeedback, which can range from galvanic skin resistance to electroencephalograph (EEG) alpha feedback. Biofeedback techniques have several implications and applications for research in both intrapersonal and interpersonal communication. Both EEG alpha and electromyograph (EMG) feedback techniques have been used successfully in reducing anxiety and result in a general relaxation of the individual, enabling him to relate more easily to others and to his environment. Specifically, EEG alpha biofeedback techniques may be advantageous to sensitivity and encounter groups, because they increase the awareness of members. EMG feedback may be used in conjunction with systematic desensitization to reduce communication apprehension. (EE)

BIOFEEDBACK AS INTRAPERSONAL COMMUNICATION

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The ubiquitous term "biofeedback" is used extensively in the popular and professional literature to label an entire gamut of phonomenon ranging from galvanic skin resistence to EEG alpha activity. This generalization in terminology has created a considerable amount of confusion in the minds of lay readers.

With the popularization of biofeedback training a unique electronic industry has developed to supply a widely diversified collection of instruments, labeled biofeedback trainers, and characterized by low unit cost and high portability. The availability, and uncomplicated utilization of biofeedback trainers warrents an examination of their possible use for the improvement of intrapersonal and interpersonal communication.

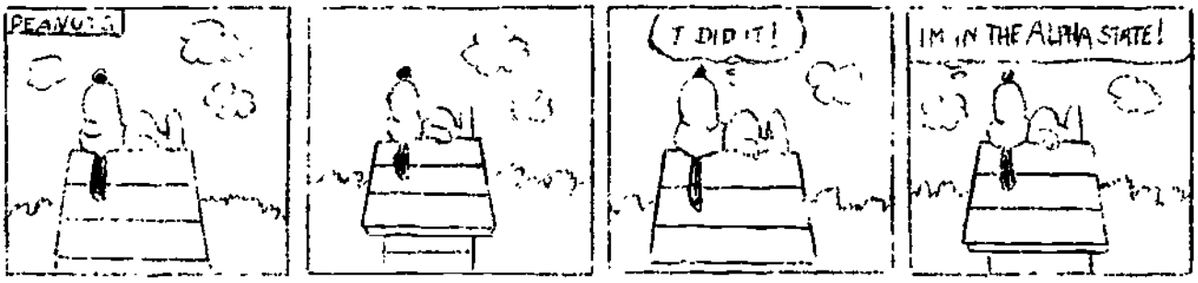
In the following review of the literature and experimental research an attempt will be made to identify the findings in relation to the pertinent phenomena being studied. While a considerable amount of the research has important implications in the field of medicine, the primary intent of this paper is to examine biofeedback techniques in relation to a unique theoretical model of intrapersonal communication. At this point it is suggested that some biofeedback techniques, especially those related to EMG and EEG devices, may have important implications for the field of speech communication.

BIOFEEDBACK

Any physiological process which can be monitored in some way may provide biofeedback. No matter what the means of obtaining the feedback, the theoretical base of biofeedback training is generally characterized by a Skinnerian model of operant conditioning. Biofeedback research has posited that by providing a subject with feedback on physiological processes which were otherwise considered autonomic, the subject can learn to control the process (Brown, 1970; Dewan, 1966; Green et al, 1969; Green, Green and Walters, 1970a; Kamiya, 1969; Mulholland and Runnals, 1963; Nowlis and Kamiya, 1970). The feedback may be in the form of some visual or auditory stimuli which is simply the result of electronic amplification of the physiological process.

"The list of variables so far shown to be modified by operant-feedback methods in man includes; electrodermal activity, heart rate speeding, slowing and stabilization, systolic and diastolic blood pressure, gross muscle potentials, single motor unit activity, alpha, beta and theta rhythems of the EEG, evoked cortical responses, skin temperature, peripheral vasomotor activity, and salivation" (Shapiro and Schwartz, 1972, p. 172-173). Behnke (1970) discusses some of these variables and several other pertinent considerations related to the utilization of physiological technologies in communication research. However, there seems to be at least four variables which are most popular. (1) The flow of blood to the extremities, measured by sensitive thermisters capable of discriminating between infintesimal changes in temperature, (2) Galvonic skin resistence (GSR) which is altered by anxiety induced palmar perspiration, (3) Muscle tension, measured by an electromyograph (EMG), and (4) Brain wave activity, monitored by an electroencephalograph (EEG). Particularly interesting is the utilization of EEG technology in learning to control brain wave activity

In order to achieve the altered state of consciousness which corresponds to each of the somewhat distinct brain wave patterns. As the popular folk hero "Snoopy" affirms, the most sought after phenomenon is the elusive alpha state



Schultz(1973)

AN INTRAPERSONAL MODEL

Theoretical model building has import and utility for every discipline, not the least of which is speech communication (Barnlund, 1968). In order to facilitate and maintain somewhat the focus of the succeeding review of experimental research, it might be appropriate to introduce a model of intrapersonal communication which will later be modified to include the conceptuallzation of biofeedback as an intrapersonal communicative process.

Fig..1

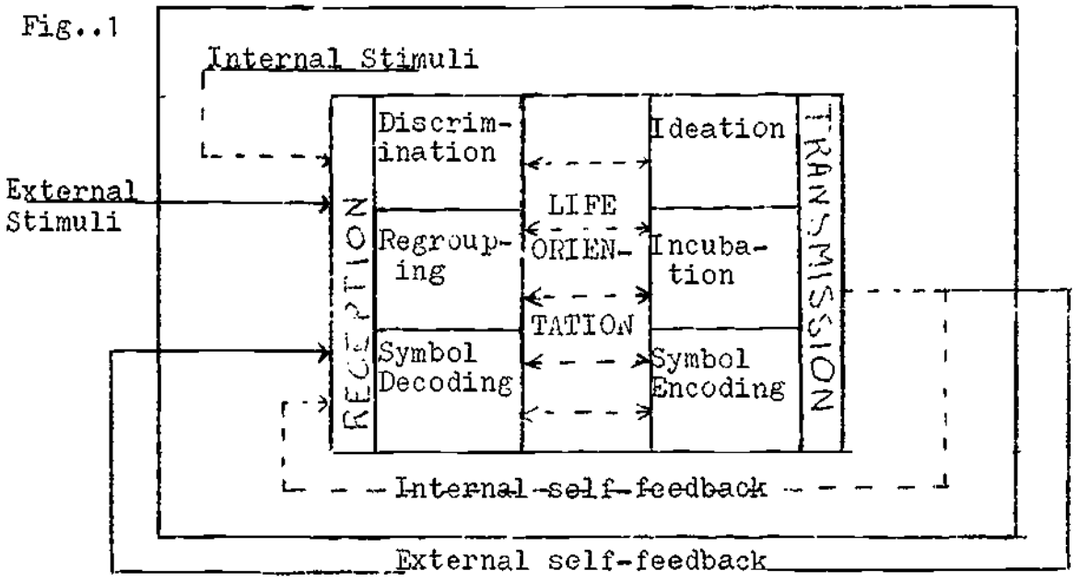


Figure I represents the Barker-Wiseman Model of intrapersonal communication (Wiseman and Barker, 1967). In this model, internal and external stimuli and feedback are received, attended to, regrouped and decoded by the communicator in relation to his life orientation. Ideation, incubation, symbol encoding and transmission complete the intrapersonal communicative process. The rectangle within the boundary of se then, represents the psycholinguistic process of encoding and decoding messages. At this point it is sufficient to note that internal stimuli, or the psychological and physiological set of an individual, may have an affect on the manner in which an individual attaches meaning to his environment and interaction, with others.

TEMPERATURE CONTROL--BLOOD FLOW

The use of biofeedback techniques to alter bodily temperature through the control of blood flow has recently been the subject of various research projects in the field of psychosomatic medicine. Probably the most pervasive project undertaken in relation to this phenomenon is the Voluntary Controls Project conducted at the Menninger Foundation by Elmer E. Green (Green, Green and Walters, 1970a). By combining the techniques of autogenic training (Schultz and Luthe, 1959) with new developments in feedback technology, Green was able to derive a practice which is termed Autogenic Feedback Training (Green, Green and Walters, 1970b). Green utilized three physiological measures in his studies in conjunction with the autogenic phrasing; hand temperature, muscle tension (EMG), and percentage of alpha rhythm (EEG). In relation to blood flow and the control of headaches, Green reports, "several of our subjects have reduced or eliminated chronic headaches through the use of autogenic phrases and a portable temperature feedback device" (Green, Green, and Walters, 1970a, p. 1315-1316).

Closely related to the studies of temperature control is an abundance of research concerning the operant conditioning of blood pressure and heart rate (Shapiro, Tursky, Gershan and Stern, 1969), (Shapiro, Tursky, and Schwartz, 1970), (Benson, Shapiro, Tursky and Schwartz, 1971), (Schwartz, Shapiro and Tursky, 1971), (Schwartz, 1972), (Lang, Sraufe and Hastings, 1967), (Hnatiaw and Lang, 1965), (Shearn, 1962). Earlier research is reviewed in Katkin and Murray (1968) and Kimmel (1967). An explanation of biofeedback and its clinical applications can be gotten from Shapiro and Schwartz (1972).

The research by Shapiro and his associates has concerned itself mainly with the control of systolic and diastolic blood pressure. From their research they report, "These results lend support to the possibility of therapeutic application of the techniques in patients with essential hypertension (Shapiro, Schwartz and Tursky, 1972, p. 296).

If we condiser the ubiquity of psychosomatic illness, then the research mentioned above has considerable import for preventive medicine. As Shapiro and Schwartz point out "The major focus of interest has been on psychosomatic disorders and on the possibility of using instrumental learning concepts and techniques in understanding the etiology maintenance, and modification of psychosomatic symptoms" (Shapiro and Schwartz, 1972, p. 174). And as Green hypothesizes, "Every change in the physiological state is accompanied by an appropriate change in the mental-emotional state, conscious or unconscious, and conversely, every change in the mental-emotional state, conscious or unconscious, is accompanied by an appropriate change in the physiological state" (Green, Green and Walters, 1970b). Thus with biofeedback techniques, control of the physiological state (internal stimuli) may be achieved, and subsequently have an effect on the mental-emotional state (another internal stimuli). Placed in this

context, biofeedback does have relevance for the researcher in speech communication, particularly in relation to the intrapersonal model discussed earlier.

GSR: GALVANIC SKIN RESISTANCE

The use of electronic paraphenalia to measure galvanic skin resistance seems to be a popularization resulting from the research on electrodermal activity (Shapiro and Crider, 1967; Shnidman and Shapiro, 1971; Shapiro and Wantanbe, 1971, 1972; Birk et al, 1966; Crider, Shapiro and Tursky, 1966). The clinical research was directed mainly toward the investigation of operant control of human autonomic responses. The development of GSR training, however, relies mostly on the general observation that anxious people have "sweaty palms and fingers." While the principle supporting GSR training is quite similar to other feedback techniques, its suggested benefits seem a bit overemphasized and are not implied by the researchers on electrodermal activity noted here.

This does not mean that GSR feedback is without import. As with the control of some psychosomatic symptoms, the control of galvanic skin resistence (i.e., sweaty palms) may lead to an alleviation of anxiety in the individual. Considering the abundance of literature in the field of speech concerning "speech anxiety" and "stage fright," (Clevenger, 1959; McCrosky, 1972; McCrosky et al, 1970; Behnke and Carlile, 1971; Giffin and Gilham, 1971; Dickens and Parker, 1951; Lamb, 1972), it is again obvious that biofeedback may create some interesting projects for the researcher in speech communication.

EMG: MUSCLE TENSION

The electromyograph (EMG) has been used extensively in research projects to provide feedback on striate muscle tension. The therapeutic and clinical applications of this procedure are quite evident. Certain therapeutic procedures

such as desensitization treatment (Wolpe and Lazarus, 1966), and meditative psychotherapy (Schultz and Luthe, 1959), (Luthe, 1965), require subjects to significantly reduce tension levels. However these procedures require an extensive treatment time before the subject can realize an adequate reduction in tension. Thus it has been suggested that "many projects might be aided by the use of a simple feedback method . . . through which extremely low tension levels . . . can be voluntarily achieved" (Green, et al, 1969).

Researchers using the electromyograph in an operant self-conditioning paradigm have noted some interesting results. The ability of subjects to produce "gallop rhythems," "drum-beat rhythems," "doublets and roll effects" has been documented (Bosmajian, 1963). Green and his associates have reported a unique "body-image" distortion in research subjects. "After about twenty minutes of feedback training . . . five out of seven subjects made statements such as "My arm feels like a bag of cement . . .as if it is moving away from me." (Green et al, 1969). In addition it was found that some subjects were able to dissociate the right forearm from the rest of the body, and tense abdominal, leg or arm muscles without increasing tension in the arm being monitored (Green et al, 1969).

In other studies, muscle feedback has been utilized to control tension headache. In this case, electrodes attached to the frontalis muscle provided the necessary imput which was then amplified and relayed back to the subject. By learning to relax the frontalis muscle, subjects were able to relax the neck and upper body, thus relieving the headache (Budzynski, Stoyva, and Adler, 1970).

EMG feedback has also been used in conjunction with systematic desensitization techniques (Budzynski, 1971). Besides facilitating relaxation in the subject,

the EMG feedback device gives the therapist a more accurate measure of the patient's tension level, thus facilitating the effectiveness of behavior modification therapy. Similarly, EMG feedback has been utilized to treat anxious subjects with a variety of psychosomatic disorders (Whatmore, 1968).

The preceding biofeedback research represents the study of a considerable array of physiological measures. As a wholistic entity the research is concerned primarily with the investigation of an equally diverse selection of psychosomatic disorders. Generally, it has been hypothesized that the ability to control the psychosomatic symptom, (The physiological process), will lead to an alteration of the mental-emotional state which creates the disorder. Although it is somewhat treacherous to generalize from this formidable collection of sophisticated research, it may be advantageous to do so. Simply, the research indicates an ability in humans to control bodily functions which were otherwise considered to be controlled only by the autonomic nervous system. This in itself represents a rather unique form of intrapersonal communication. This however is not the only implication for the field of speech.

The most obvious consideration is in relation to systematic desensitization and its use to alleviate communication apprehension. McCrosky (1972) reports considerable success with this methodology for overcoming "speech fright." The clinical research in this area has shown that EMG biofeedback greatly accelerates this therapeutic process and also provides the therapist with some observable measure of the subject's tension level. Thus it would seem advantageous to append bio-feedback techniques to McCrosky's systematic desensitization treatment process. With the utilization of EMG bio-feedback techniques, the time required to reduce the subject's tension level may be greatly diminished. Further research, possibly combining these two methodologies,

or utilizing the Autogenic Feedback Training technique developed by Green may indeed provide some insight for the field of speech communication.

EEG: ALPHA AND THETA

Biofeedback research utilizing electroencephalographic technology has primarily attempted to correlate certain brain wave patterns with specific states of consciousness. Generally, brain waves may be categorized in a hierarchy of frequency ranges, each with a somewhat distinctive wave pattern. They are: beta--more than 13 Hertz (H_z), alpha--8 to 13 H_z, theta--4 to 8 H_z, and delta less than 4 H_z. It should be noted that these are arbitrary distinctions commonly utilized by professional researchers. Several states of consciousness have been identified (Kripner, 1969) and while it has seemed rather difficult to relate each one to a specific EEG activity, certain correlates have been examined. Generally, the production of alpha waves has been associated with a feeling of relaxed awareness, an inner calm, or a quieting of the mind. Theta is most evident when subjects pass from wakefulness to sleep, and is associated with creative reverie. Delta is most common in sleep, whereas beta is associated with high exitation and even aggression.

Some of the early EEG research dealt with sleep, and the transitional phases that one goes through when falling from wakefulness to sleep (Dement and Kleitman, 1957) (Faulkes, 1964 in Tart SD, 1969) (Tart, 1965 in Tart (ed) 1969), (Bertini, Lewis and Witkin, 1964 in Tart (ed.), 1969), (Vogel, Faulkes and Trasmin, 1966 in Tart (ed.), 1969). The significant interest here was in the structuring of ego functions as an individual passed from wakefulness, through a hypnogogic state, into sleep.

Other researchers were more interested in the brainwave correlates of some forms of meditation, Zen and Raj Yagi, (Green et al, 1970; Anand, Chhina and

Singh, 1961; Kasamatsu and Hirai, 1966) and transcendental meditation (Wallace, 1970). They found high amplitude alpha present in Zen meditators, even in the occipital lobes, and an ability in transcendental meditators to block out the external physical world when producing alpha during meditation. Kamiya (1969) has found that subjects who previously were students of some form of meditation are better alpha producers, as are psychotherapists who deal mainly in sensitivity. He also notes that he feels more positively disposed toward individuals who subsequently are good alpha producers. While this relationship between alpha wave activity and communicative behavior is a rather tenuous one, it coincides somewhat with the subjective reports of relaxed awareness and oneness associated with the so-called alpha state. As such it represents an additional consideration for speech communication research.

Still other researchers have concentrated on the relationship between EEG and attention (Mulholland and Runnals, 1962, 1963; Mulholland, 1969; Adey, Kado and Walter, 1967; Roth, 1961), extra sensory perception (Krippner and Ullman, 1969, 1970 a,b,; Stanford and Lovin, 1970; Ullman, Krippner and Feldstein, 1966), personality (Broodhurst and Glass, 1969; Casra, Cox and Katzman, 1965; Sisson and Ellingston, 1955; Walters, 1961), drugs, (Fink, 1969; Ulett and Itel, 1969) hypnosis (Galbraith and London, 1970; London, Hart and Leibovitz, 1968; O'Connell and Orne) and the theta rever e of creativity (Green, Green, and Walters, 1970b).

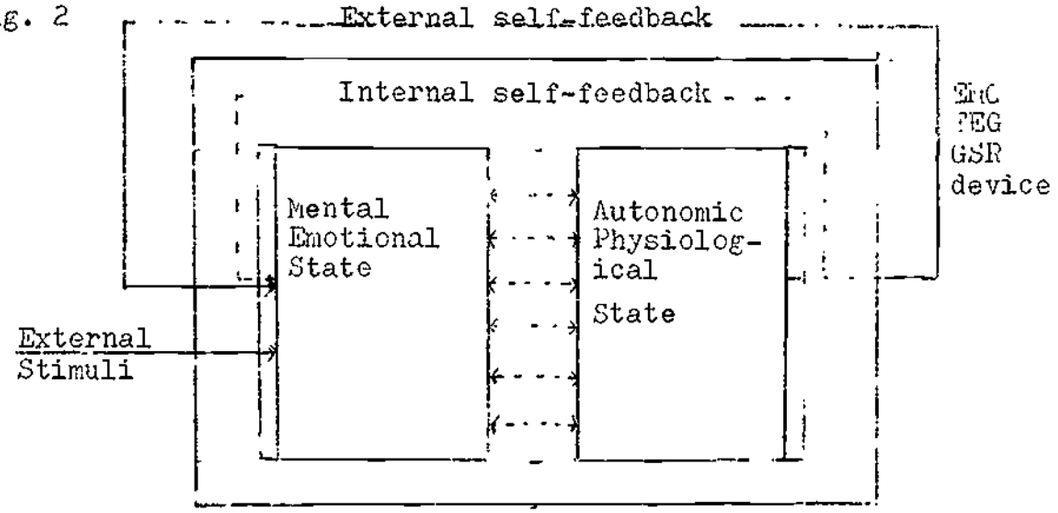
One interesting application of alpha conditioning is reported by Marjorie Toomin as a result of experimentation at the Annie Wall School-Hospital (Toomin and Toomin, 1972). The pilot study "indicates that these children were positively benefited by two half-hour alpha bio-feedback sessions per week for four weeks" (Toomin and Toomin, 1972, p. 6). The results indicate the alleviation of insomnia, stuttering and hyperkinetic behavior.

THE INTRAPERSONAL BIOFEEDBACK MODEL

Throughout the review of the literature and research, the primary intent was to specify some of the "interna. stimuli" which have been manipulated through biofeedback techniques. As the model clearly stipulates, these internal stimuli may have an impact on the encoding and decoding of messages. Thus there is an indirect affect on interpersonal communicative behavior, somewhat substantiated by subjective reports.

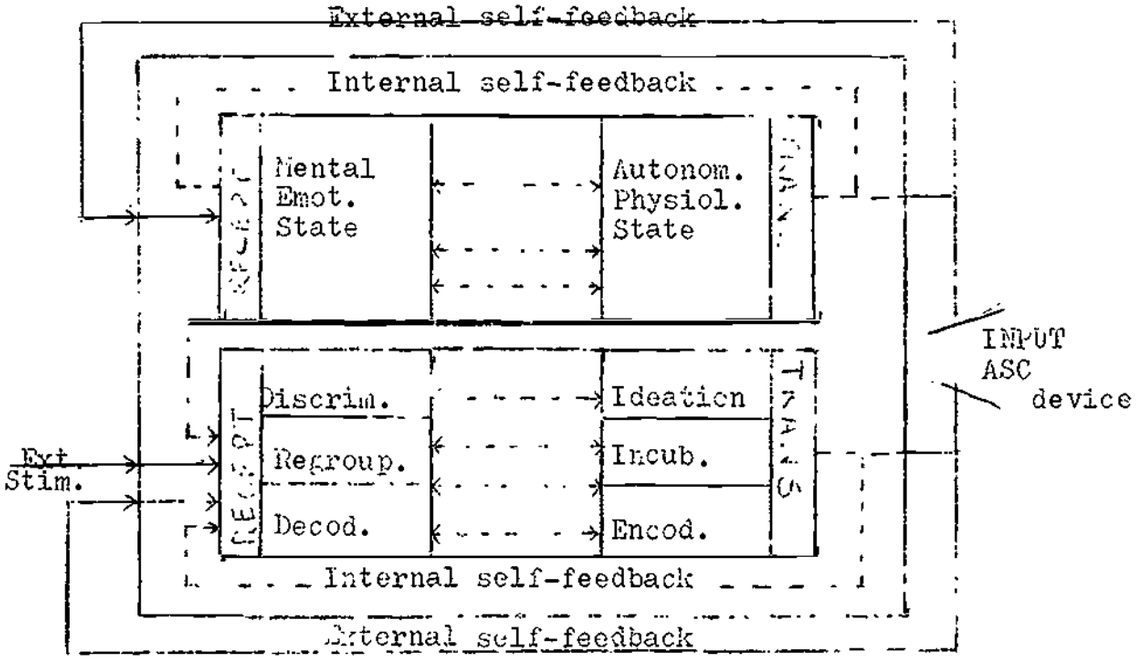
However, biofeedback techniques would seem to be even more intensely intrapersonal than Figure 1 suggests, since the monitoring of physiological messages is done without reference to another individual. Thus, instead of dealing with the conscious psycholinguistic process of message encoding and decoding, biofeedback deals with the autonomic physiological processes. By combining the diagramatical techniques of Barker and Wiseman, with the psychophysiological hypothesis of Green, a unique intrapersonal biofeedback model can be developed. Figure 2 represents this model, which in itself is an expansion of the psychological and physiological internal stimuli of Figure 1.

Fig. 2



Thus there develops a rather unique model of intrapersonal communication in which the individual attends only to stimuli which are provided to him by the electronic amplification of his own physiological processes.

By superimposing the two models upon each other, the impact of this intrapersonal biofeedback upon the encoding and decoding of messages may be noticed. Figure 3 represents this overlay.



As was mentioned before, the psychological and physiological set of the individual constitutes some kind of internal stimuli which is attended to when decoding and encoding messages. As the biofeedback research has pointed out, control of the mental emotional state may be gotten indirectly through control of the physiological state.

Biofeedback then does have some affect on communicative behavior as implied by this theoretical model. The designation of an input device (EMG, EEG, GSR, systematic desensitization, drugs, hypnosis, meditation) serves to conceptualize the phenomenon of altered states of consciousness (ASC) associated with some biofeedback techniques. It should be emphatically noted here that none of the input devices guarantee an ASC. Merely, their input into the feedback loops, and indirect effect on the physiological and psycholinguistic

process may lead to an altered state of consciousness when utilized.

DISCUSSION

In addition to being a rather unique form of intrapersonal communication, biofeedback techniques have several implications and applications for research in the field of speech. The most obvious consideration, again might be in relation to the work by McCrosky and other researchers dealing with speech anxiety and/or communication apprehension.

However, the subjective reports by Kamiya (1969), in relation to the communicative behavior of some of his alpha-wave subjects, are most interesting. There seems to be some tenuous relationship between an individual's ability to produce alpha, and his ability to relate to others. Subjects in alpha-experiments often report a feeling of openness, relaxed awareness, or feeling of well being. This then is the altered state of consciousness suggested by the utilization of bio-feedback devices in Figure 3.

The preliminary work of Abraham Maslow (1969 a, b) in the field of transpersonal psychology may have some relevance here. Characterized as the fourth force in the field of psychology, transpersonal psychology is derived directly from humanistic psychology (Toomin, 1972, p. 1). Where humanistic psychology deals primarily with the development of self and self actualization, transpersonal psychology deals with the intensely intrapersonal (transpersonal) state. Transpersonal psychology is interested in a detachment from normal ego functioning and cognitive conceptualization, an altered state of consciousness, maximal sensory awareness, a transcendence of self. Bio-feedback then, provides the means by which an individual can transcend his own consciousness cognitive framework. If we consider the individual represented by Figure 3, we can begin

to understand how attending only to the internal stimuli could create this altered state. Other stimuli, along with the cognitive organization or the "life orientation," are ignored.

The relevance that transpersonal psychology and biofeedback techniques may have for interpersonal behavior is more evident if we examine the process of percept and concept formulation. Generally, when we are confronted with a new situation, we attempt to relate it to our past experiences or "life orientation." This process involves a certain amount of cultural conditioning. "We perceive and process sensory data against the screen of well-worn and perhaps irrelevant cognitive maps." (Toomin, 1972) Deautomization, or the suspension of these cognitive organizations, described by Deikman (1966), is a primary facet of the transpersonal experience. If these cognitive organizations or life orientations could be transcended or ignored, "percepts and concepts then enter our consciousness new and fresh" (Toomin, 1972).

Thus, alpha wave training, as it has been characterized by a relaxed awareness and openness, may be a rather simple process leading to improved communicative behavior. If our cognitive organizations could be transcended, such that our interactions with others would not be coupled with a conditioned evaluative perception then communicative behavior may be more spontaneous, open and honest. Similarly, if misconceptions concerning the evaluative content of messages could be transcended, then defensive behaviors might not be quite so evident.

CONCLUSION

Several conclusions may be drawn from the previous discussion and review of the literature and experimental research:

1) Bio-feedback techniques may be utilized in conjunction with any physiological process which can be monitored.
2) EMG and EEG alpha feedback techniques have been used successfully in reducing anxiety.
3) EEG activity is negatively correlated with anxiety.
4) EMG feedback may be used advantageously in conjunction with systematic desensitization in order to reduce communication apprehension.
5) EEG alpha feedback techniques may lead to a transcendance of conscious cognitive maps and thus facilitate more open communication.
6) EEG and EMG training may result in a general relaxation of the individual, enabling him to more easily relate to others and his environment.
7) The use of EEG alpha biofeedback techniques may be advantageous to sensitivity and encounter groups by increasing the openness and relaxed awareness of members.

These represent only a few of the many obvious implications of the popularization of bio-feedback training. A more careful examination of the research would undoubtedly produce several additional statements. As such this paper serves to distinguish between various biofeedback technologies and to suggest the utility of bio-feedback as a yet unexploited area for research in speech communication. The utilization of technology in conjunction with the teachings of eastern meditation is in itself an interesting phenomenon described here by the Toomins,

> Biofeedback is a social phenomenon. It is an expression of the increasing value placed on self-regulation, an enhancing natural processes, on inward focusing, and on perceiving man as a mind-body unit. At a time when technology and humanism seem to be pulling in different directions, bio-beedback provides man with a way to use technology in the most personal ways possible--to lead to self-discovery, self-awareness, self control, and self-determination. (Toomin and Toomin, 1972).